

No. 12.— *Reports on the scientific results of the Expedition to the Tropical Pacific in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer Albatross, from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., Commanding.*

XVIII.

Reports on the scientific results of the Expedition to the Eastern Tropical Pacific in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer Albatross from October, 1904, to March, 1905, Lieut. Commander L. M. Garrett, U. S. N., Commanding.

XXX.

Ophiuroidea.

By HUBERT LYMAN CLARK.

THE number of ophiurans collected by the ALBATROSS on her Tropical Pacific expeditions was not large and it has seemed best to make a single report on the two collections. They were originally sent to Professor Ludwig at Bonn, but he had made only a preliminary examination when his untimely death cut short his researches. There are in all about 550 specimens, representing 50 species. Of these 168 specimens of 20 species were taken during the cruise of 1899-1900, and 381 specimens of 33 species were collected in 1904-05. There are also included a very few specimens taken by the ALBATROSS in 1891, which have never yet been placed on record. Only 7 species are new to science and one third of the remainder are common shallow-water species of Pacific reefs and shores.

OPHIOMYXIDAE.

OPHIOGERON EDENTULUS.

Lyman, 1878. Bull. M. C. Z., 5, p. 161. 1882. Challenger Oph., pl. 12, fig. 16-18.

A single specimen, with the disk-covering torn away, measures 5 mm. across the disk and has arms 18-20 mm. long. It is somewhat

larger therefore than the CHALLENGER specimens from near the Fiji Islands. The species has not previously been collected since the CHALLENGER report was issued.

Station 4732. A thousand miles east of the Paumotu Islands, Eastern Tropical Pacific, 2012 fms. Bott. temp. 34.8°. Glob. oz.

TRICHAETERIDAE.

ASTEROSHEMA MONOBACTRUM,¹ sp. nov.

Plate 1, fig. 1, 2.

Disk, 8 mm. in diameter; arms 80–90 mm. long; width of arm at base, about 2 mm.; height of arm at base, about 1.8 mm. Disk flattened, slightly higher than arms, concave at center (in dry specimen), covered by a granular membrane; near center of disk there are about 50 granules to a square millimeter, while near margin there are not more than 30. Radial shields almost completely concealed, but in the dry specimen appear as low, rounded ridges, about 3 or 4 times as long as the wider, outer end. Arms rather squarish (in cross-section) at base and wider than high, but becoming more arched dorsally and apparently higher than wide; they are covered by a granulated skin like that of disk but near tip, the granules are more and more separated until the skin is almost naked and the granules very minute. Genital slits very conspicuous, the two together occupying nearly all the interbrachial space; each is 2 mm. long and .60–.75 mm. wide; the narrow vertical area or ridge separating them is sunk conspicuously below the rest of the interbrachial area. Oral shields, adoral plates, and oral plates completely concealed beneath granulated skin of disk. Oral papillae (if they can be called such) not more than two on a side, nearer tip of jaw than base, small, rounded and knob like, irregular in form, size, and position. Tooth papillae none. Teeth 4 or 5, rounded triangular. Under arm-plates (if present) at base of arm, concealed by granulated skin; at middle of arm and beyond where skin is thin and nearly or quite naked, there seem to be no under arm-plates. Tentacle-pores small but distinct; diameter equal to about one eighth of distance between first and second pairs of pores on arm. Buccal pair and first arm-pair with no

¹ μόνος = single + βᾶκτρον = club, in reference to the single tentacle-scale on basal pores of arm.

tentacle-scales; second arm-pair, and following 10-15 pairs have a single, cylindrical tentacle-scale; distally this scale is more and more thickened and rough or even prickly at tip. Beyond basal part of arm, each tentacle-pore is guarded by two scales, of which the outer is much the smaller, scarcely half the size of the inner, which may be over a millimeter long, considerably exceeding the arm-segment. Color of dry specimen, dull cream-color.

Station 3685. Off the Marquesas Islands, Eastern Tropical Pacific, 830 fms. Bott. temp. 38°. Vol. s., glob.

One specimen.

This species is very different from *A. sublaevis* of the Galapagos Islands and Panamic region, its nearest ally geographically. Nor does it resemble any more closely the related forms of the western Pacific. On the contrary it is really nearer to *A. arenosum* of the West Indies than to any other species, so far as general appearance and granulation of disk and arms is concerned. The size and arrangement of the genital slits and the absence of a second tentacle-scale on the basal arm-segments serve as excellent marks of distinction.

OPHIACANTHIDAE.

OPHIACANTHA CONTIGUA.

Lütken and Mortensen, 1899. Mem. M. C. Z., 23, p. 173, pl. 17, fig. 7-9.

Six specimens, ranging in size from 4 to 6.5 mm. across the disk agree very closely with the original description and figures of *O. contigua*. There are, however, more oral papillae, 4 or even 5 being present on each side of each jaw.

Station 4621. Panama: off Mariato Point. 581 fms. Bott. temp. 40.5°. Gn.s., gn. m., r.

OPHIACANTHA COSMICA.

Lyman, 1878. Bull. M. C. Z., 5, p. 146. 1882. Challenger Oph., pl. 13, fig. 13-15.

In addition to some excellent specimens, with disks ranging from 10 to 15 mm. across, there are some specimens from an unknown station which are in wretched condition.

Station 4651. 111 miles northwest of Aguja Point, Peru. 2222 fms. Bott. temp. 35.4°. Fne. stk. gy. m.

Station 4674. 86 miles southwest of Palominos Light House, Peru. 2338 fms. Fne. dk. gn. m., r.

Eleven specimens.

OPHIACANTHA QUADRISPINA,¹ sp. nov.

Plate 1, fig. 3, 4; Plate 2, fig. 3.

Disk, 18 mm. in diameter; arms about 100 mm. long. Disk covered by a coat of fine scales which is more or less completely concealed beneath a covering of coarse granules, 25-35 per square millimeter. About one square millimeter or a little more of the distal end of each radial shield is bare. Upper arm-plates wider than long, separated or barely in contact, diamond-shape but with distal angle much more obtuse than proximal; near tip of arm, they are nearly triangular and about as long as wide. On the interbrachial areas below, the granulation occupies only the central, marginal portion, the region bordering the genital slits and distal to the oral shield being quite bare, though covered with very fine scales. Genital slits of unequal lengths, sometimes equal to only the two basal arm-segments and sometimes equal to four. Oral shields distinctly wider than long; the madreporite is pentagonal with slightly concave sides, and is widest proximally; the other shields are diamond-shaped with rounded angles, slightly concave sides and a conspicuous distal projection into the interradiar area. Adoral plates nearly or quite straight with almost parallel sides, about 3 times as long as wide, meeting broadly in the interradii but separated radially by the first under arm-plate; often, but by no means always, a distal projection of the adoral plate separates the oral shield from the first under arm-plate; in the 40 possible cases, this projection is present 25 times. Oral plates superficially about as large as adorals; on the margin of each are 3-6 papillae of very variable size and arrangement; as a rule the distalmost is largest and the middle ones smallest, but the distal ones may be quite lacking. Teeth five in each column; below (or external to) lowest, is a group of 2-4 tooth-papillae, each about equal to half a tooth. First under arm-plate, small, squarish, a little

¹ *Quadrispinus* = having four spines; in reference to the small number of arm-spines.

wider than long; succeeding plates wider than long (until past middle of arm) pentagonal or somewhat heptagonal, with a proximal angle and slightly concave sides; they are separated throughout. Side arm-plates large, low and wide, meeting both above and below; each carries 4 blunt spines, of which the upper three are very flat and wide; the two middle spines are chisel like at tip and in length are equal to two or two and a half arm-segments; none of the spines are prickly but under a lens, the margins are very finely serrate. Tentacle-scales 2, large and flat; they are situated on the side arm-plate but the inner is very close to the under arm-plate; inner scale a trifle the longer and distinctly the narrower, about equal in length to the lateral margin of the under arm-plate; beyond the middle of the arm the inner scale is much the smaller and is attached to the under arm-plate, and still further out it disappears altogether. Color dull purplish brown above, whitish beneath; arms conspicuously banded with these two shades, the bands each 2-6 segments wide, but the whitish bands always the narrower.

Station 4642. Galapagos Islands: Hood Island, 4 miles southeast of Ripple Point. 300 fms. Bott. temp. 48.6°. Brk. sh., glob.

Station 4643. Galapagos Islands: Hood Island, 5 miles southwest of Ripple Point. 100 fms. Bott. temp. 67.2°. Brk. sh., glob.

Four specimens.

This is a very well-marked species, not likely to be confused with any other. While it resembles *O. normani* in having four arm-spines, the shape of those spines is very different; the presence of two tentacle-scales and the absence of granules on the upper arm-plates are additional differences of great importance. The superficial appearance is much like that of some specimens of *O. cataleimmoida*, but that species has six or seven arm-spines and only a single tentacle-scale. In tentacle-scales, under arm-plates, and mouth-parts, *O. quadrispina* is very similar to *O. valenciennesi*, but that species has seven or eight arm-spines and spinules on the upper arm-plates. The constancy in the number of arm-spines in *O. quadrispina* is very striking for there are no more than four on the basal arm-segments and there are not fewer than four on the distal segments until near the tip of the arm. It seems fair then to consider this one of the characteristic endemic brittle-stars of the Galapagos Islands, very few of which are as yet known.

OPHIACANTHA SENTOSA.

Lyman, 1878. Bull. M. C. Z., 5, p. 140. 1882. Challenger Oph., pl. 13, fig. 10-12.

The Albatross specimens are not quite so large as those taken by the CHALLENGER, but they do not exhibit any noteworthy differences. The depth at which the species lives is notable.

Station 4658. West of Peru, $8^{\circ} 30' S.$, $85^{\circ} 36' W.$, 2370 fms. Bott. temp. 35.3° . Fne. gn. m., mang. nod.

Station 4666. West of Peru, $11^{\circ} 55' S.$, $84^{\circ} 20' W.$, 2600 fms. Bott. temp. 34.9° . Fne. gy. rad. oz.

Station 4672. Southwest of Palominos Light House, Peru, 88 miles. 2845 fms. Bott. temp. 35.2° . Fne. dk. br. infus. m.

Bathymetrical range, 2370-2845 fms. Extremes of temperature, 35.3° - 34.9° .

Three specimens.

OPHIACANTHA VALENCIENNESI.

Lyman, 1879. Bull. M. C. Z., 6, p. 57. 1882. Challenger Ech., pl. 26, fig. 7, 8.

The specimens of this well-marked, nearly cosmopolitan species are notable for the development of the spinules on the upper arm-plates. They may occur out as far as the twentieth segment or a little beyond and there may be 5 or 6 on the distal margin of each plate. On the basal segments, there are pointed granules, rather than spinules.

Station 4642. Galapagos Islands: Hood Island, 4 miles south-east of Ripple Point. 300 fms. Bott. temp. 48.6° . Brk. sh., glob.

Four specimens.

OPHIOTOMA PAUCISPINA.

Ophiacantha paucispina Lütken and Mortensen, 1899. Mem. M. C. Z., 23, p. 175, pl. 18, fig. 1-4.

Ophiotoma paucispina H. L. Clark, 1915. Mem. M. C. Z., 25, p. 218.

The specimens are in poor condition and throw little light on the character of the species or on its relationship to the other members of the genus.

Station 4647. West of Peru, $4^{\circ} 33' S.$, $87^{\circ} 42' 30'' W.$, 2005 fms.
Bott. temp. $35^{\circ} 4$. Lt. gy. and br. glob. oz.
Two specimens.

AMPHILEPIDIDAE.

AMPHIACTIS DUPLICATA.

Amphiura duplicata Lyman, 1875. Illus. cat. M. C. Z., no. 8, pt. 2, p. 19,
fig. 87; pl. 5, fig. 78.
Ophiactis duplicata Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 142.
Amphiactis duplicata Matsumoto, 1915. Proc. Acad. nat. sci. Philadelphia,
67, p. 67.

This series is not noteworthy. The range in size is from 3.5 to 5.5 mm. across the disk.

Station 3407. Galapagos Islands: $4' S.$, $90^{\circ} 24' 30'' W.$, 885 fms.
Bott. temp. 37.2° . Glob. oz.

Station 4641. Galapagos Islands: Hood Island, 12 miles south-east of Ripple Point. 633 fms. Bott. temp. 39.5 . Lt. gy. glob. oz.

Station 4642. Galapagos Islands: Hood Island, 4 miles southeast of Ripple Point. 300 fms. Bott. temp. 48.6° . Brk. sh., glob.

Bathymetrical range, 300–885 fms. Extremes of temperature, 48.6° – 37.2° .

Twelve specimens.

AMPHILEPIS PATENS.

Lyman, 1879. Bull. M. C. Z., **6**, p. 34. 1882. Challenger Oph., pl. 19, fig. 1–3.

Amphilepis platytata H. L. Clark, 1911. Bull. 75 U. S. N. M., p. 171, fig. 76.

This series shows that the differences which were supposed to distinguish *A. platytata* from *A. patens* (absence of tentacle-scales and of disk-scaling on the lower surface) are probably growth-stages, or at any rate a matter of individual diversity. In two specimens, with disk-diameter 6.5–8 mm., there are no tentacle-scales and the interbrachial areas below are perfectly naked; they are thus like the type of *A. platytata* which was 8 mm. across the disk. The other specimens are 10–12.5 mm. across the disk and the interbrachial areas below are fully covered with scales.

There is no doubt of the identity of the specimen labeled 3389, but it is possible that there is some mistake about the station number,

as the original label is not with the specimen. It seems highly improbable that this species occurs in 210 fms. at a temperature of 48.8° .

Tentacle-scales are either present or absent, generally present on the majority of the pores. The oral papillae are exceedingly variable in number, size, form, and position, so that no reliable specific character can be based on them.

Station 3389. Off Panama, $7^{\circ} 16' 45''$ N., $79^{\circ} 56' 30''$ W., 210 fms. Bott. temp. 48.8° . Gn. m.

Station 4647. Eastern Tropical Pacific, $4^{\circ} 33'$ S., $87^{\circ} 42' 30''$ W., 2005 fms. Bott. temp. 35.4° . Lt. gy. and br. glob. oz.

Station 4649. Eastern Tropical Pacific, $5^{\circ} 17'$ S., $85^{\circ} 20'$ W., 2235 fms. Bott. temp. 35.4° . Fne. stky. gy. m.

Station 4651. 111 miles west of Aguja Point, Peru; $5^{\circ} 42'$ S., 83° W. 2222 fms. Bott. temp. 35.4° . Fne. stky. gy. m.

Station 4717. Eastern Tropical Pacific, $5^{\circ} 11'$ S., $98^{\circ} 56'$ W., 2153 fms. Bott. temp. 35.2° . Rd. c., glob. oz.

Bathymetrical range, 210(?)–2235 fms. Extremes of temperature, 48.8° (?)– 35.2° .

Ten specimens.

AMPHIURIDAE.

OPHIACTIS SAVIGNYI.

Ophiolepis savignyi Müller and Troschel, 1842. Syst. Ast., p. 95.

Ophiactis savignyi Ljungman, 1867. Öfv. Kongl. vet.-akad. Förh., **23**, p. 323.

The specimens are all young and in no way noteworthy.

Panama: Perico Island.

Ellice Islands: Funafuti.

Gilbert Islands: Taritari.

Thirteen specimens.

AMPHIURA DIOMEDEAE.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 151, pl. 12, fig. 1–7.

The specimens of this wide-ranging Pacific species are in good condition. The disk-diameters are 8–14 mm.

Station 3687. Tahiti: off Point Venus, 4.8 miles. 725 fms. Bott. temp.? Vol. s., yl. m.

Station 4631. Panama: off Mariato Point, 72 miles. 774 fms. Bot. temp. 38° . Gn. s.

Station 4654. Peru: off Aguja Point, 24 miles. 1036 fms. Bott. temp. 37.3°. Dk. br. m.

Bathymetrical range, 725-1036 fms. Extremes of temperature, 38°-37.3°.

Eight specimens.

AMPHIURA GYMNOGASTRA.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 145, pl. 9, fig. 6-8.

These Amphiuuras are perplexing, for while they have the interbrachial spaces below perfectly naked as in *A. gymnogastra*, there are only 3 or 4 arm-spines, and these are not small and sharply pointed as they should be, but are long, thick, and blunt as in some specimens of *A. serpentina*. In fact these specimens are quite intermediate between *A. gymnogastra* and *A. serpentina*. It is possible that they are hybrids, but more probably the two species are not distinct, the naked skin of the interbrachial areas in *A. gymnogastra* being a temporary condition due to peculiarities of breeding or possibly a stage of extreme maturity. The differences in the arm-spines of the two nominal species is not constant, specimens of *A. serpentina* with 5 small, sharp arm-spines being known.

Station 4642. Galapagos Islands: Hood Island, 4 miles southeast of Ripple Point. 300 fms. Bott. temp. 48.6°. Brk. sh., glob.

Five specimens.

AMPHIURA SEMINUDA.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 148, pl. 11, fig. 1-3.

These specimens, with disks about 5 mm. across, are in poor condition, but there is no question as to their identity.

Station 3689. Paumotu Islands: 4 miles southwest of northwest point of Marokau. 807 fms. Bott. temp. 37.6°. Co. s., mang.

Two specimens.

AMPHIPIOLIS GRANULATA.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 155, pl. 10, fig. 1-4.

Although this little specimen (disk-diameter 3 mm.) was taken by the ALBATROSS in 1891, it is from a station from which the species was not previously recorded.

Station 3389. Off Panama, $7^{\circ} 16' 45''$ N., $79^{\circ} 56' 30''$ W., 210 fms.
Bott. temp. 48.8° . Gn. m.

One specimen.

AMPHIOPLUS DALEA.

Amphiura dalea Lyman, 1879. Bull. M. C. Z., **6**, p. 27. 1882. Challenger
Oph., pl. 18, fig. 11-13.

Amphioplus dalea Verrill, 1899. Trans. Conn. acad., **10**, p. 315.

Although the type-locality for this species is in the southwestern Atlantic, it has been recorded twice from the Eastern Tropical Pacific. These specimens are not noteworthy in any particular save that they are mostly adults (disk-diameter 5-13 mm.) and are very well preserved.

Station 4649. Eastern Tropical Pacific, $5^{\circ} 17'$ S., $85^{\circ} 20'$ W., 2235 fms. Bott. temp. 35.4° . Fne. stky. gy. m.

Station 4670. 105 miles northeast of Palominos Light House, Peru. 3209 fms. Bott. temp. 35.4° . Fne. dk. br. m.

Sixty specimens.

AMPHIOPLUS LAEVIS.

Amphiura laevis Lyman, 1874. Bull. M. C. Z., **3**, p. 229, pl. 4, fig. 18-21.

Amphioplus laevis Verrill, 1899. Trans. Conn. acad., **10**, p. 315.

There is a single specimen of this fine species from Taritari, Gilbert Islands. The disk is nearly 6 mm. across and the arms about 65 mm. long.

OPHIOTRICHIDAE.

OPHIOTHRIX DEMESSA.

Lyman, 1861. Proc. Boston soc. nat. hist., **8**, p. 82. Koehler, 1905. Siboga-
Exp. Oph. litt., pl. 9, fig. 5, 6.

Most of the specimens are small and in poor condition, but there is no mistaking this characteristic Pacific species.

Paumotu Islands: Makemo. Fakarava.

Thirteen specimens.

OPHIOTHRIX GALAPAGENSIS.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 181, pl. 20, fig. 1-4.

These are very typical specimens, with disks 5-7 mm. across.

Station 4642. Galapagos Islands: Hood Island, 4 miles southeast of Ripple Point. 300 fms. Bott. temp. 48.6°. Brk. sh., glob.

Three specimens.

OPHIOTHRIX LONGIPEDA.

Ophiura longipeda Lamarek, 1816. Anim. sans vert., **2**, p. 544.

Ophiothrix longipeda Müller and Troschel, 1842. Syst. Ast., p. 113.

There is a single specimen from Papeete, Tahiti, of this well-known species and two others with only the label "35". The significance of this number is unknown.

OPHIOTHRIX SPICULATA.

Leconte, 1851. Proc. Acad. nat. sci. Philadelphia, **5**, p. 318.

These specimens range in disk-diameter from 4 to 7 mm. and are quite typical of the species.

Panama: Perico Island. Tobaquilla Island.

Fifteen specimens.

OPHIOTHRIX TRILINEATA.

Lütken, 1869. Add. ad hist. Oph., pt. 3, p. 58, 100.

These are very typical specimens of this handsome and wide-spread species, but all are small, the disk-diameter ranging from 3 to only 6 mm.

Paumotu Islands: Makemo. Fakarava.

Thirty-four specimens.

OPHIOCHITONIDAE

OPHIONEREIS ANNULATA.

Ophiolepis annulata Leconte, 1851. Proc. Acad. nat. sci. Philadelphia, **5**, p. 317.

Ophionereis annulata Lyman, 1860. Proc. Boston soc. nat. hist., **7**, p. 203.

These specimens are adults, with disks 7-8 mm. across. The one from Perico has the ground-color distinctly olive-green, while in the other specimens it is very light brown.

Panama: Perico Island. Tobaquilla Island.

Three specimens.

OPHIONEREIS PORRECTA.

Lyman, 1860. Proc. Boston soc. nat. hist., 7, p. 260. 1865. Illus. cat. M. C. Z., no. 1, p. 147, fig. 14, 15.

These specimens range from 3 to 9 mm. across the disk.

Paumotu Islands: Makemo.

Marshall Islands: Jaluit.

Three specimens.

OPHIOCOMIDAE.

OPHIOCOMA AETHIOPS.

Lütken, 1859. Add. ad hist. Oph., pt. 2, p. 141, 145.

There are a dozen specimens of this well-known species from Perico Island, Panama.

OPHIOCOMA ALEXANDRI.

Lyman, 1860. Proc. Boston soc. nat. hist., 7, p. 256.

There are nine specimens of this species from Perico Island, Panama.

OPHIOCOMA BREVIPES.

Peters, 1851. Monats. K.-Preus. akad. wiss. Berlin, p. 465.

The species of *Ophiocoma* with two tentacle-scales and a very finely granulated disk are very perplexing. Whether we are dealing with one, two, or three species is still uncertain. For the present, I think it best to distinguish two species, *O. brevipes* and *O. insularia*, and under the latter name, a typical form and a long-spined variety. This, at least, is the division best adapted to the present collection. The coloration of *O. brevipes* is its conspicuous character and seems to be quite constant; there is a ground-color of very pale yellowish white with a distinctly greenish cast, and this is more or less marked with blotches and streaks of dusky or greenish; on the arms these

darker markings are chiefly apparent as transverse bands; the arm-spines usually show spots or markings of dusky. As a rule, the arm-spines of *O. brevipes* are shorter and less flattened than those of *O. insularia*.

Paumotu Islands: Makemo. Fakarava.

Seventeen specimens.

OPHIOCOMA ERINACEUS.

Müller and Troschel, 1842. Syst. Ast. p. 98.

The specimens are all small, the largest having a disk only 15 mm. across.

Paumotu Islands: Makemo. Fakarava.

Seventeen specimens.

OPHIOCOMA INSULARIA.

Lyman, 1861. Proc. Boston soc. nat. hist., 8, p. 80.

The specimens here listed as *O. insularia* differ from *O. brevipes* only in size, color, and arm-spines. They are from 10 to 22 mm. across the disk, of very dark shades of brown, and with long, flattened arm-spines. One specimen (from Papeete) is uniformly deep purplish brown above and light wood-brown below. All the other specimens, save one, have the arms more or less banded with dull yellowish on the brown background, and even the disk may be variegated with dull yellowish, or the specimens are variegated with light and dark shades of brown. The one exception is from Easter Island and differs so much from the other specimens that I propose to call it variety *longispina*. In coloration it is uniformly blackish brown like *O. erinaceus*, but the *granulations* are very fine and the tentacle-scales are narrow and pointed. It differs from typical *O. insularia* in two important particulars. The jaws are moderately long with very evident oral plates, while in *O. insularia* the jaws are very short and wide with almost no oral plates. The arm-spines of which there may be five are exceedingly long and slender, 5-6 mm. long and equal to four or five arm-segments. As the arm-spines of *Ophiocoma* are excessively variable and unreliable, this may be only an individual peculiarity, but it profoundly affects the appearance of the specimen.

Tahiti: Papeete. Three specimens.

Easter Island. Twelve specimens.

OPHIOCOMA PARVA.

H. L. Clark, 1915. Mem. M. C. Z., **25**, p. 292, pl. 14, fig. 8, 9.

These specimens show little diversity and agree well with the original specimens from Torres Strait.

Paumotu Islands: Makemo. Fakarava.

Twenty-eight specimens.

OPHIOCOMA PICA.

Müller and Troschel, 1842. Syst. Ast., p. 101.

The specimens of this beautiful species are small, only 7–11 mm. across the disk.

Paumotu Islands: Makemo.

Three specimens.

OPHIOCOMA SCOLOPENDRINA.

Ophiura scolopendrina Lamarck, 1816. Anim. sans vert., **2**, p. 544.

Ophiocoma scolopendrina Müller and Troschel, 1842. Syst. Ast., p. 101.

There is nothing notable about the series of this common and well-known species.

Paumotu Islands: Makemo. Fakarava. Rangiroa.

Seventeen specimens.

OPHIOMASTIX BISPINOSA, sp. nov.

Plate 2, fig. 1, 2.

Disk, 5 mm. in diameter; arms about 40–45 mm. long. Disk covered with a thick skin completely concealing the scales; scattered irregularly over the dorsal side of the disk are about 60 small, slender spinelets scarcely half a millimeter long. No radial shields visible. Upper arm-plates oval, the greatest width *proximal* to middle; the outlines are obscured by the skin in which they seem to lie. Inter-brachial areas below smooth, apparently naked save for a few small spinelets near margin. Oral shields oval, about as wide as long, the greatest width distal to middle. Adoral plates and oral plates small and more or less concealed by skin. Oral papillae 3 or 4 on each side,

the distalmost largest. Tooth-papillae only 3-5 on each jaw tip. Under arm-plates tetragonal with slightly rounded corners, longer than wide, little or not at all in contact. Side arm-plates moderately large, meeting below; each carries 2 or 3 prominent spines; when 3 are present, the uppermost is largest and is often very large, its length equalling 2-3 arm-segments and its thickness proportionately great; near the middle of the arm, segments with two or with three spines alternate with considerable regularity; the big uppermost spines occur at intervals of 2-5 segments and alternate on the two sides of the arm. Tentacle-scale single, small and rounded. Color (dried):—disk dull light olive with a very few lighter markings; disk-spines dull yellowish; upper arm-plates dull olive but at intervals of 4-6 segments, the upper arm-plate is dull cream-color; upper half of side arm-plates and uppermost spines, usually dull olive but when upper arm-plate is cream-color the adjoining side arm-plate and the uppermost spine it carries is usually the same; lower surface of disk and arms, including smaller arm-spines very pale brown; some arm-spines more or less distinctly annulated with dusky or olive.

Paumotu Islands: Makemo.

One specimen.

Although this specimen is obviously immature, it differs so much from previously known members of the genus, it is necessary to designate it by a new name. The name given is based on one of the striking features, the presence of only two arm-spines on many of the side arm-plates. This character taken in connection with the disk-covering, the upper arm-plates and the coloration will serve to distinguish the species at once from all other members of the genus.

OPHIODERMATIDAE.

OPHIODERMA PANAMENSE.

Lütken, 1859. Add. ad hist. Oph., pt. 2, p. 91.

Two specimens from Perico Island, Panama, call for no comment.

OPHIODERMA PENTACANTHA,¹ sp. nov.

Plate 3; Plate 4, fig. 1, 2.

Disk, 27 mm. in diameter; arms 145-150 mm. long. Disk covered with the usual coat of coarse, overlapped scales, completely con-

¹ πέντε = five + ἀκανθα = a spine, in reference to the five arm-spines.

cealed by the smooth uniform layer of fine granules, about 150 to a square millimeter. Radial shields entirely concealed. Upper arm-plates tetragonal, becoming almost triangular at very tip of arm, where they are as long as wide; on basal portion of arm they are 3-4 times as wide as long and cover the entire dorsal surface of arm. Basal half of arm distinctly keeled, though the keel is low and rounded. Interbrachial areas below uniformly covered with the fine coat of granules of disk. Genital slits four in each interbrachial area. Oral shields triangular with very rounded angles, a trifle wider than long. Adoral plates very small, bare, at distal corners of oral shields. Oral plates completely concealed by granules. Oral papillae 9-10 on each side, the two distalmost and the most proximal one, largest; far up in the mouth-slit, on the side of each jaw is a conspicuous pointed papilla as large as the largest of the oral papillae. Teeth about five. No true tooth-papillae. Under arm-plates at first hexagonal with strongly convex distal side which soon develops angles, making the plate octagonal; on basal half of arm, the plates are much wider than long; distally they become tetragonal with rounded corners and ultimately they are longer than wide. Side arm-plates low and small; each carries 5 rather stout, flat, blunt arm-spines, of which the uppermost is smallest, about half as long as side arm-plate, and the lowest is conspicuously largest, much exceeding the plate; on distal part of arm there are of course only 4, and then 3 arm-spines. Tentacle-scales 2, the inner narrower than the outer and very much longer, commonly longer than the side of the under arm-plate which it adjoins; outer scale flat and truncate, overlying the base of the lowest arm-spine. Color (dried):—light and dark brown, with a slight grayish cast; disk with dark blotches on a lighter background; arms more or less distinctly banded; under surface of disk fawn-color, of arms nearly white, except distally.

Station 4643. Galapagos Islands: Hood Island, 5 miles southwest of Ripple Point. 100 fms. Bott. temp. 67.2°. Brk. sh., glob.

Five specimens.

This fine species, one of the most easily recognized in the genus, is indeed an interesting discovery. It resembles *O. elaps* of the West Indian region more nearly than it does any other species, but is at once distinguishable from that form by the small number of arm-spines. As a characteristic species of the Galapagos region, *Ophioderma pentacantha* will probably be entitled to high rank.

OPHIOPEZELLA SPINOSA.

Ophiarachna spinosa Ljungman, 1867. Öfv. Kongl. vet.-akad. Förh., **23**, p. 305.

Ophiopezella spinosa Lyman, 1882. Challenger Oph., p. 17.

The specimens are all young and quite small but the identity seems clear.

Paumotu Islands: Makemo. Fakarava. Rangiroa.

Society Islands: Tahiti, Papeete.

Four specimens.

OPHIOLEPIDIDAE.

AMPHIOPHIURA ABCISA.

Ophioglypha abcisa Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 117, pl. 2, fig. 1-3.

Amphiophiura abcisa Matsumoto, 1915. Proc. Acad. nat. sci. Philadelphia, **67**, p. 78.

The specimen is in poor condition but its identity seems fairly certain.

Station 4705. Eastern Tropical Pacific, 15° 05' S., 99° 19' W., 2031 fms. Bott. temp. 35.3°. Lt. yl. br. glob. oz.

One specimen.

OPHIURA FLAGELLATA.

Ophioglypha flagellata Lyman, 1878. Bull. M. C. Z., **5**, p. 69. 1882. Challenger Rep., pl. 4, fig. 16-18.

Ophiura flagellata Meissner, 1901. Bronn's Thierreichs, **2**, abt. 3, p. 925.

The specimens are adults with the arms all badly broken.

Station 4641. Galapagos Islands: Hood Island, 12 miles south-east of Ripple Point. 633 fms. Bott. temp. 39.5°. Lt. gy. glob. oz.

OPHIURA IRRORATA.

Ophioglypha irrorata Lyman, 1878. Bull. M. C. Z., **5**, p. 73. 1882. Challenger Oph., pl. 5, fig. 7-9.

Ophiura irrorata Meissner, 1901. Bronn's Thierreichs, **2**, abt. 3, p. 925.

A good series, mostly in good condition. In size the specimens range from young ones, only 2.5-6 mm. across the disk, to adults

15–20 mm. across. There is some diversity in the scaling of the disk, in the size of the radial shields and in the basal under arm-plates, but the differences are relatively unimportant.

Station 3684. Eastern Tropical Pacific, 50' N., 137° 45' W., 2463 fms. Bott. temp.? Gy. yl. glob. oz.

Station 4647. Eastern Tropical Pacific, 4° 33' S., 87° 42' 30'' W., 2005 fms. Bott. temp. 35.4°. Lt. gy. and br. glob. oz.

Station 4649. Eastern Tropical Pacific, 5° 17' S., 85° 20' W., 2235 fms. Bott. temp. 35.4°. Fne. stky. gy. m.

Station 4651. West of Aguja Point, Peru, 111 miles. 2222 fms. Bott. temp. 35.4°. Fne. stky. gy. m.

Station 4658. West of Peru, 8° 30' S., 85° 36' W., 2370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.

Station 4670. West of Palominos Light House, Peru, 105 miles. 3209 fms. Bott. temp., 35.4°. Fne. dk. br. m.

Station 4672. Southwest of Palominos Light House, Peru, 88 miles. 2845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.

Station 4742. Eastern Tropical Pacific, 4' S., 117° 7' W., 2320 fms. Bott. temp. 34.3°. Fne. lt. gy. glob. oz.

Bathymetrical range, 2005–3209 fms. Extremes of temperature, 35.4°–34.3°.

Forty-eight specimens.

OPHIURA STENOBRACHIA,¹ sp. nov.

Plate 5, fig. 1, 2.

Disk 9 mm. in diameter; arms all broken but it seems improbable that they exceeded 18–20 mm.; they are very slender only 1.3 mm. in diameter at base. Disk covered by about 150–200 plates among which the primaries can scarcely be distinguished; the disk is highly arched, its thickness at center being nearly 3 mm.; the margin of each interradian area is nearly or quite fully occupied by a single large plate, little of which, however, is visible from above. Radial shields moderately large, roughly triangular, nearly or quite as wide as long, in contact at outer ends but well separated within. Arm-comb small, not extending well up on to the upper surface of the arm, composed of few, flat, blunt, close-set papillae, of which the uppermost are largest. Upper arm-plates triangular, exceedingly small, about as long as wide, separated (except on the first two basal seg-

¹ στενός = narrow + βραχίων = arm, in reference to the very slender arms.

ments) by a distance greater than their own length. Interbrachial areas below covered by about half a dozen large plates, with sometimes a few much smaller ones among them. Oral shields very similar in appearance to these interbrachial plates, broadly triangular or pentagonal; in one specimen they are as long as wide or longer, while in the other they are distinctly wider than long. Adoral plates very long, straight, and narrow. Oral plates also long and narrow, but shorter and perhaps wider than adorals. Oral papillae about 8 on each side, very small, subequal. First under arm-plate nearly twice as wide as long, its proximal side very short, like a truncated angle; second plate larger, more swollen, and more nearly rectangular; third plate about like first; succeeding plates smaller and smaller, nearly or quite three times as wide as long; no two of the under arm-plates are in contact and the distal ones are very widely separated. Side arm-plates long and relatively large, meeting broadly both above and below; they are larger distally than proximally, so that the arm seen from either above or below has a wavy outline; each side arm-plate bears 3 short, sharp, subequal spines about half as long as the plate; these spines are borne on the lower half of the distal margin of the plate. Oral tentacle-pores open on face of jaw, entirely outside of mouth-slits; they have 4 or 5 scales on each side. Tentacle-pores of first arm-segment similar but somewhat smaller, with 3 or 4 tentacle-scales on each side. Tentacle-pore of second arm-segment, much smaller guarded by 2 scales or only 1. Succeeding pores very small and guarded by a single minute scale. Color (dried): — very pale brown.

Station 4647. Eastern Tropical Pacific, $4^{\circ} 33' S.$, $87^{\circ} 42' 30'' W.$ 2005 fms. Bott. temp. 35.4° . Lt. gy. and br. glob. oz.

Two specimens.

These specimens are not in good condition, but the specific characters are obvious. The highly arched disk covered by numerous plates, the very slender arms with remarkably reduced upper and under arm-plates, and the reduced condition of the tentacle-pores make an unusual combination, and gives this *Ophiura* a very characteristic facies.

OPHIURA UNDULATA.

Ophioglypha undulata Lyman, 1878. Bull. M. C. Z., **5**, p. 75. 1882. Challenger Oph., pl. 5, fig. 10-12.

Ophiura undulata Meissner, 1901. Bronn's Thierreichs, **2**, abt. 3, p. 925.

In the Catalogue of recent ophiurans (Mem. M. C. Z., **25**) I referred this species to *O. irrorata* as a synonym. The CHALLENGER

specimen was the only one known and it seemed probable that it was merely an individual variant of the widely distributed and variable *O. irrorata*. The ALBATROSS specimens have convinced me that I was wrong and that *O. undulata* is a good species. The coarser disk-scaling and the stout arm-spines are very characteristic. Lyman's figures are excellent, but in the specimens before me the disk-scales are more regularly arranged than in his type. The large plates are surrounded by smaller ones in a somewhat ornate pattern. In one specimen, the primary plates are very distinct. In these individuals the disk is 14 mm. across, so they are somewhat larger than the CHALLENGER specimen.

Station 3689. Paumotu Islands: Marokau, 4 miles west of north-west point. 807 fms. Bott. temp. 37.6°. Co. s., mang.

Two specimens.

OPHIOMUSIUM CANALICULATUM,¹ sp. nov.

Plate 5, fig. 5-8.

Disk, somewhat highly arched, 8 mm. in diameter, rather more than 2 mm. high; arms all broken, slender, apparently about 25 mm. long. Disk covered by the six primary plates, the large radial shields and two additional plates in each interradius, the lower one of these two forming the margin of the disk; three very small plates occur in interstices between large plates. Radial shields moderately large, larger than any of the primary plates, in contact with each other for almost their full length. All the disk-plates are shagreened. Upper arm-plates *none*, unless a minute triangular plate between the distal ends of the radial shields be construed as such. Interbrachial areas below covered by 2 (in one interradius 3) plates, in addition to the wide but very short marginal plate. Oral shields diamond-shaped, somewhat wider than long; in the interradius with 3 plates in the interbrachial area the distal angle of the oral shield is truncate, causing the shield to become pentagonal. Adoral plates well developed but not large, about 2.5 times as long as wide. Oral plates somewhat shorter and a little wider. Oral papillae very indistinct, apparently six or seven, but all fused into a narrow marginal piece along the oral slits. First under arm-plate minute and indistinct, apparently longer than wide; second under arm-plate, slightly

¹ *Canaliculatus* = grooved, in reference to the deep median, longitudinal furrows on the arms.

pentagonal or almost triangular, about .40 mm. long and not quite so broad; third similar but smaller; beyond the third segment there are no under arm-plates. Side arm-plates relatively very large, meeting completely both above and below. Along the median line, on both the upper and lower surfaces of the arm, is a conspicuous longitudinal groove or furrow. Each side arm-plate bears 3 or 4 very minute, sharp spinelets of rather unequal size; the largest are not equal to one third the length of the segment. Tentacle-pores present only in connection with the second and third under arm-plates; they are very minute, lie near the proximal angle (or side) of the plate, and have no tentacle-scales. Entire under surface of animal shagreened. Color (dried):—very pale brown.

Station 4732. Eastern Tropical Pacific, $16^{\circ} 32' 30''$ S., $119^{\circ} 59'$ W., 2012 fms. Bott. temp. 34.8° . Glob. oz. •

One specimen..

The remarkable reduction in the number of plates composing the disk and arms of this *Ophiomusium* is really notable. Without upper and under arm-plates (save on the lower side of two basal joints), with no tentacle-scales, and with a disk composed of only about 65 plates, the species is not likely to be confused with any of those hitherto known.

OPHIOMUSIUM GLABRUM.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 132, pl. 4, fig. 7-9.

The present large series seems to show that this is the characteristic brittle-star of the deep waters of the Eastern Tropical Pacific. The specimens range from 5 to 33 mm. across the disk.

Station 4647. Eastern Tropical Pacific, $4^{\circ} 33'$ S., $87^{\circ} 42' 30''$ W., 2005 fms. Bott. temp. 35.4° . Lt. gy. and br. glob. oz.

Station 4649. Eastern Tropical Pacific, $5^{\circ} 17'$ S., $85^{\circ} 20'$ W., 2235 fms. Bott. temp. 35.4° . Fne. stky. gy. m.

Station 4651. West of Aguja Point, Peru, 111 miles. 2222 fms. Bott. temp. 35.4° . Fne. stky. gy. m.

Station 4656. West of Peru, $6^{\circ} 55'$ S., $83^{\circ} 34'$ W., 2222 fms. Bott. temp. 35.2° . Fne. gn. m., mang. nod.

Station 4658. West of Peru, $8^{\circ} 30'$ S., $85^{\circ} 36'$ W., 2370 fms. Bott. temp. 35.3° . Fne. gn. m., mang. nod.

Station 4666. West of Peru, $11^{\circ} 55'$ S., $84^{\circ} 20'$ W., 2600 fms. Bott. temp. 34.9° . Fne. gy. rad. oz.

Station 4672. Southwest of Palominos Light House, Peru, 88 miles. 2845 fms. Bott. temp. 35.2° . Fne. dk. br. infus. m.

Station 4717. Eastern Tropical Pacific, $5^{\circ} 11' S.$, $98^{\circ} 56' W.$, 2153 fms. Bott. temp. 35.2° . Rd. c., glob. oz.

Station 4721. Eastern Tropical Pacific, $8^{\circ} 7' 30'' S.$, $104^{\circ} 10' W.$, 2084 fms. Bott. temp.? Lt. br. glob. oz.

Station 4732. Eastern Tropical Pacific, $16^{\circ} 32' 30'' S.$, $119^{\circ} 59' W.$, 2012 fms. Bott. temp. 34.8° . Glob. oz.

Station 4740. Eastern Tropical Pacific, $9^{\circ} 2' S.$, $123^{\circ} 20' W.$, 2422 fms. Bott. temp. 34.2° . Dk. gy. glob. and rad. oz.

Station 4742. Eastern Tropical Pacific, $4' S.$, $117^{\circ} 7' W.$, 2320 fms. Bott. temp. 34.3° . Fne. lt. gy. glob. oz.

Bathymetrical range, 2005–2845 fms. Extremes of temperature, 35.4° – 34.2° .

One hundred and forty specimens.

OPHIOMUSIUM JOLLIENSE.

McClendon, 1909. Univ. Cal. publ. Zool., 6, p. 36, pl. 1, fig. 2, 3.

These specimens are very young, with disks little more than 4 mm. across, but their identity seems sure.

Station 4641. Galapagos Islands: Hood Island, 12 miles southeast of Ripple Point. 633 fms. Bott. temp. 39.5° . Lt. gy. glob. oz.

OPHIOMUSIUM LYMANI.

Wyville Thomson, 1873. Depths of the sea, p. 172, fig. 32, 33.

It is remarkable that no specimens of this common and very widespread deep water brittle-star were taken by the ALBATROSS on either the 1899–1900 nor the 1904–05 expedition. The present specimens are very young and were taken in 1891.

Station 3407. Galapagos Islands: northeast of Albemarle Island. 885 fms. Bott. temp. 37.2° . Glob. oz.

Station 3431. Gulf of California, $23^{\circ} 59' N.$, $108^{\circ} 40' W.$, 995 fms. Bott. temp. 37° . Lt. bn. m.

Two specimens.

*
OPHIOMUSIUM TRIPASSALOTUM,¹ sp. nov.

Plate 5, fig. 3, 4.

Disk, little arched, 6.5 mm. across; arms very slender about 33 mm. long. Disk covered by about 50 rather small plates, slightly swollen around the margins, among which the primary plates can be distinguished; a large marginal plate in each interradius, with a smaller plate directly above it are much the largest of the disk-plates. Radial shields large, distinctly longer than wide (but scarcely equal to one half radius), broadly in contact, but at distal end separated very slightly by a small triangular plate. On each side of this plate is a smaller, transversely elongated, conspicuously swollen plate, the three forming a noticeable group at the base of each arm. Upper arm-plates minute, triangular, very widely separated, but remarkably persistent, present nearly or quite to the tip of the arm. Entire upper surface of disk and arms quite smooth, not at all shagreened. Interbrachial areas below covered by 6-12 smooth, irregular plates of very diverse sizes and arrangement. Oral shields pentagonal, longer than wide. Adoral plates long, straight, and narrow, the length fully 3-4 times the width. Oral plates evident, but much smaller than adorals. Oral papillae 5-7 on each side, very low and wide and not very distinct; the distal ones are widest. First under arm-plate minute about twice as long as wide; second under arm-plate much larger, shield-shaped but greatly elongated; it is widest distally, but even there is not half as wide as its length; third under arm-plate small not much longer than wide; no under arm-plates beyond third arm-segment. Side arm-plates relatively large and long, considerably swollen proximally, meeting fully above and below, but with no trace of a longitudinal groove on either surface of arm; each plate carries, on its lower distal corner, 3 small, blunt, subequal, peg-like arm-spines, about one fourth as long as arm-segment. Tentacle-pores present on arms only beside the proximal part of the under arm-plates on the second and third segments; each is provided with a large tentacle-scale. Color (dried):—very light, nearly white.

Station 3690. Paumotu Islands: 2 miles west of Hao Atoll. 812 fms. Bott. temp. 37.6°. Co. s.

One specimen.

The persistence of the upper arm-plates, while the under ones are

¹ τρεῖς = three + πάσσαλος = a peg, in reference to the three peg-like arm-spines.

lacking, combines with the non-shagreened and rather numerous disk-plates, and the small, grouped arm-spines to give this species a very characteristic facies. It does not seem to be very nearly related to any previously known species.

OPHIOZONELLA CLYPEATA.

Ophiozona clypeata Lyman, 1883. Bull. M. C. Z., **10**, p. 234, pl. 3, fig. 13-15.

Ophiozonella clypeata Matsumoto, 1915. Proc. Acad. nat. sci. Philadelphia, **67**, p. 82.

I have hesitated referring this specimen to the West Indian species, *O. clypeata*, but it is fully adult (10 mm. across the disk) and in excellent condition and I can find no valid reason for giving it a new name. It differs slightly from the type of *O. clypeata* in the scaling of the disk and in the shape of the oral shields, but these differences are so trifling that one cannot seriously consider them as due to anything more than individual diversity.

Station 4642. Galapagos Islands: Hood Island, 4 miles southeast of Ripple Point. 300 fms. Bott. temp. 48.6°. Brk. sh., glob.

One specimen.

OPHIOTYPA SIMPLEX.

Koehler, 1897. Ann. sci. nat. Zool., ser. 8, **4**, p. 281, pl. 5, fig. 1-3.

It is a matter of considerable interest to find this very remarkable brittle-star in the eastern Pacific. It is known from the Indian Ocean and from the eastern Atlantic, so it seems probable that it is cosmopolitan. These specimens are of full size and well preserved, but show no noteworthy features of their own.

Station 4721. Eastern Tropical Pacific, 8° 7' 30'' S., 104° 10' W., 2084 fms. Bott. temp.? Lt. br. glob. oz.

Two specimens.

OPHIOLEUCIDAE.

OPHIERNUS ANNECTENS.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 107, pl. 5, fig. 4-6.

The specimens are in very bad condition but there is no reason to doubt their identity.

Station 4641. Galapagos Islands: Hood Island, 12 miles southeast of Ripple Point. 633 fms. Bott. temp. 39.5° . Lt. gy. glob. oz. Two specimens.

OPHIERNUS SEMINUDUM.

Lütken and Mortensen, 1899. Mem. M. C. Z., **23**, p. 105, pl. 5, fig. 10-12.

The specimens are fairly well preserved and are quite typical. They measure 10-15 mm. across the disk.

Station 4651. West of Aguja Point, Peru, 111 miles. 2222 fms. Bott. temp. 35.4° . Fne. stky. gy. m.